Poster Number: 81

MetroHealth Medical Center

RESEARCH DAY 2023

Abstract Submission Form

Poster Title: **Synergizing Neuromodulatory Therapies: Leveraging Homeostatic Neuroplasticity to Facilitate Post-Stroke Motor Recovery**

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Location of Laboratory: **Old Brooklyn Campus**

Category: **Physical Medicine and Rehabilitation**

Hemiparesis of the upper-limb is one of the most serious impairments from stroke. Paresis of the finger and thumb extensors is a frequently persisting consequence of stroke, impacting hand function. We developed contralaterally controlled functional electrical stimulation (CCFES), a neuromuscular stimulation therapy that gives the patient intimate control of both stimulation timing and intensity to their finger and thumb extensors during intention driven hand opening. Several clinical trials have reported reduced impairment, and improved function of the affected upper-limb function and dexterity with CCFES. Our main objective is to build upon these therapeutic benefits of CCFES therapy for chronic stroke motor recovery. One strategy to improve rehabilitation outcomes is to combine treatments that may have synergistic effects. Therefore, this study applies non-invasive brain stimulation to the motor cortex during CCFES to determine if the combination of the two will improve outcomes over those achieved by CCFES alone. Conventionally, tDCS has been applied to increase brain excitability of the ipsilesional hemisphere with anodal stimulation and inhibit the contralesional hemisphere with cathodal stimulation; however, benefits of tDCS combined with therapy have varied. The variable results may be influenced by the dynamics of homeostatic neuroplasticity. Homeostatic neuroplasticity is defined as a relationship of neural balance between long-term potentiation (LTP), which is crucial for recovery, and long-term depression (LTD). When exciting the motor areas with tDCS, the nervous system may seek an equilibrium, potentially causing LTD during rehabilitation. In this project, we are testing the opposite approach: inhibiting the ipsilesional hemisphere, i.e. unconventional tDCS. We hypothesize that the nervous system will attempt to restore balance by promoting LTP during CCFES-assisted therapy, enhancing post-stroke motor recovery. We will conduct a randomized controlled trial (RCT) of mild to moderately impaired 63 stroke survivors 6 to 24 months' post-stroke. They will be assigned to 12 weeks of: a) conventional tDCS during CCFES, b) unconventional tDCS during CCFES, or c) sham tDCS during CCFES. Upper extremity impairment, activity limitation and neurophysiologic assessments will be made at baseline, 6, 12, 24, and 36 weeks. This will be the first RCT of tDCS during CCFES in chronic upper extremity hemiplegia and serve to accelerate the development of treatments for reducing post-stroke hemiparesis.